The Vermisphere Concept

Earthworm Activity and Sewage Sludge

Land application significantly increases non-erodable soil aggregates by *Lumbricus terrestris* — and such activities lead to the vermisphere concept.

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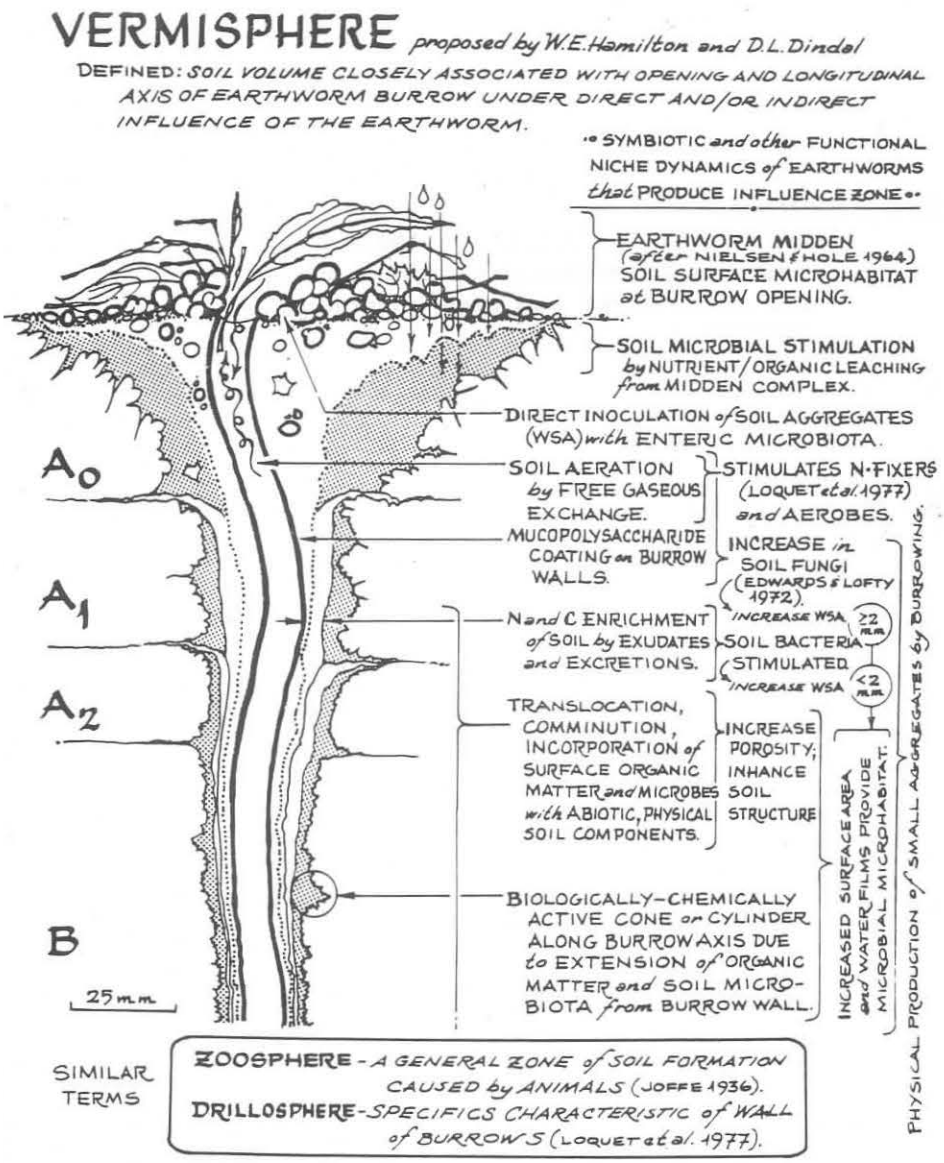
VALUES of water stable soil aggregates produced by earthworms have been shown as an indicator of environmental impact related to municipal wastewater application (DINDAL *et al.* 1979). Our further field and microcosm studies are oriented to the influence of land application of municipal sewage sludge on earthworm dynamics and production of water stable aggregates (WSA). Forest and meadow soils with known earthworm populations were treated with 5 cm of aerobically digested sludge and WSA were analyzed 1 yr. after; WSA were also assessed from sludge-earthworm amended microcosms. Distributions of WSA were determined using wet sieving technique of KEMPER and CHEPIL (1965). Data were expressed by vectoral arrays and multivariate descriptions of percent of water stable sample in 6 aggregate size classes, and by mean weight diameter (MWD) parameter of YOUKER and McGUINNESS (1957).

Sludge application treatment increased the percentages of 4 and 2 mm WSA and MWD in both forest and meadow soils. Ordination and trellis representations of field data indicate that the magnitude of changes in WSA distribution is influenced by an active earthworm fauna in direct response to land applied sludge. Population densities in *Lumbricus terrestris* L. (the site dominant earthworm in this study) is positively correlated (r=0.97 [forest] and 0.98 [meadow]) with the percentage of 4 mm WSA.

Microcosms comprised of 4.8 kg silty-clay loam subsoil amended with 7 gm (2 adult) *L. terrestris* showed a 504 gm increase in 4 and 2 mm WSA over controls after 110 days incubations. Of this increase a maximum of 231 gm (45.8%) is attributable to direct soil casting by worms (maximum casting potential for Lumbricidae equals 30% body weight per day CROSSLEY *et al.* 1971) while at least 273 gm (54.2% must be caused by alternative consequences of earthworm



(Ed. Note: This report is a compiled overview by the authors from a poster presented at the VIII International Colloquium on Soil Zoology in August, 1982, Louvain-la-Neuve, Belgium and from a paper presented at the 13th Composting—Waste Recycling Conference, May, 1983 at Columbus, Ohio. Subsequent manuscripts regarding details of this subject are in preparation. Research was supported in part by a McIntire-Stennis grant.)

activity. The "vermisphere effect" (Figure 1) is our summation of these alternative effects of earthworm activity related to such things as symbiosis with soil microbes, natural leaf litterfall, human influences and all abiotic factors of the ecosystem. ■

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Reference citation:

Hamilton, W.E. and D. L. Dindal. 1983. The vermisphere concept: earthworm activity and sewage sludge. BioCycle–*J. Waste Recycling* 24(5):54-55.